CLAIMS

1. An optical multiplexing apparatus comprising:

a tunable light source for providing a light beam , the beam having a wavelength that varies periodically through a range of wavelengths at a sweep frequency rate,

a first splitting means for splitting the polarized light beam into a signal beam and a reference beam,

a second splitting means for splitting the signal beam into N sub-beams;

means for imparting a different time delay to each of the N sub-beams means for imparting a distinctly different polarization state to each of the sub-beams in order to associate each of the N sub-beams with a different polarization state,

means for recombining the sub-beams with different polarization states into a single optical beam.

means for interfering the single optical beam with the reference beam in order to obtain an output light signal whose amplitude is varying in time, and

means for detecting the output light signal and resolving it into its frequency components wherein

the time delay for each the N sub-beam is selected such that a unique frequency component of the output light signal is associated with each one of N different polarization states.

2. The apparatus of claim 1 wherein N is four and the different polarization states are linear horizontal, linear diagonal, linear vertical and right-hand circular.

3. The apparatus of claim 1 wherein the interfering means is one of Mach Zehnder interferometer, a Tyman Green interferometer, a Michelson interferometer, and a Fabry-Perot interferometer (

4. An apparatus as defined in Claim 1 comprising further a device under test wherein the single optical beam is optically coupled to the device under test and the output of the device under test is optically coupled to the interfering means.

5. A method of producing a multiplexed light beam having a number of distinct polarization states, the method comprising the following steps:

a) splitting an input light beam into N sub-beams,

b) imparting a different time delay to each of the N sub-beams,

c) imparting a different polarization state to each of the N sub-beams, and

d) recombining the N sub-beams into a single combined light beam containing the supersposition of the N polarization states.

6. A method for measuring optical properties of an optical device, the method comprising the steps of:

providing a light beam of varying frequency from a frequency-tunable light source,

splitting the light beam into a first light beam and a reference light beam,

splitting the first light beam into N sub-beams,

imparting a different time delay to each of the N-sub-beams,

imparting a different polarization state to each of the N sub-beams,

recombining the N sub-beams into a single combined light beam containing the supersposition of the N polarization states ,

passing the single combined light beam through a device under test to produce a transmitted light beam,

imparting a path length difference between the single combined light beam and the reference light beam,

combining the transmitted light beam and the reference light beam to cause interference therebetween and to produce an output beam, and

analyzing the frequency content of the output beam to detect optical properties of the device under test.

7. An apparatus for measuring optical properties of an optical device, the apparatus comprising

a frequency-tunable light source,

a beam splitter coupled to receive a light beam from the source and to split the light beam into a signal beam and a reference beam,

an interferometer having at least a first and a second optical paths having different path length, coupled to pass the signal beam through the first path and the reference beam through the second path,

a second beam splitter disposed in the first path to split the signal beam into N sub-beams;

means for imparting a different time delay to each of the N sub-beams,

means for imparting a distinctly different polarization state to each of the sub-beams,

means for recombining the sub-beams with different polarization states into one recombined optical beam to be interfered with the reference beam in the interferometer to form an interfered beam, and

means for analyzing the interfered beam in the frequency domain.